
Mortality, Cardiovascular Risk Factors, and Diet in China, Finland, and the United States

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Synopsis

Mortality, cardiovascular risk factors, and diet were compared in Tianjin province, People's Republic of China; in North Karelia Province, Finland; and in the United States as a whole.

People in Tianjin received 7 percent of their energy intake from saturated fats, whereas people in the United States received 13 percent and those in North

Karelia received 20. The mean blood cholesterol levels for men were 158 milligrams per deciliter (mg per dl) for Tianjin, 216 mg per dl for the United States, and 241 mg per dl for North Karelia. The smoking prevalence among men was highest in Tianjin (66 percent), followed by the United States (42 percent) and Finland (36 percent).

The differences among mortality rates for the three locales were less pronounced among women than among men. Age-standardized total mortality for women was highest for Tianjin and lowest in North Karelia. The reverse was true for men. Age-standardized total mortality for men was lowest in Tianjin and highest in North Karelia.

Age-standardized ischemic heart disease mortality for men was lowest in Tianjin (99 per 100,000) and highest in North Karelia (730 per 100,000). For women, the corresponding figures were 83 per 100,000 in Tianjin and 164 per 100,000 in North Karelia. Although salt intake was higher in Tianjin than in North Karelia, the blood pressure was on average lower in persons from Tianjin than in those from North Karelia. The stroke mortality rate in Tianjin, however, was much higher than in either Finland or the United States.

The strong discrepancy in stroke mortality relative to prevalence of hypertension and salt intake raises the issue of the etiology of stroke in Tianjin. Recently it has been reported that hemorrhagic stroke may be more common among people whose blood cholesterol level is very low and blood pressure level high. This joint condition may be relatively common in Tianjin and calls for longitudinal and case-control studies to clarify the relationships among these factors in Tianjin.

CARDIOVASCULAR DISEASE (CVD) and cancer are two of the major public health problems in the industrialized world. These diseases are closely related to everyday lifestyle. It has been clearly shown that smoking causes lung cancer and CVD and contributes significantly to many other chronic diseases (1). It has been clearly shown also that a high proportion of saturated fats in the diet is associated with elevated blood cholesterol levels and high coronary heart disease mortality. Obesity, high salt intake, and excess alcohol use are the contributors to high blood pressure, the main risk factor for stroke (2).

Cardiovascular disease rates are declining in many

industrialized countries, including the United States (3) and Finland (4). The decline in mortality has been attributed to changes in lifestyle, secondarily to targeted cardiovascular health programs and to improved medical management. On the other hand, many countries have increasing CVD rates (5, 6). CVD rates, especially for ischemic heart disease, have been relatively low in many developing countries but are increasing with the adoption of western smoking and diet habits as well as with a possible overall decrease in physical activity. In many of these countries, cancer and cardiovascular diseases already are the major causes of mortality (7, 8). The key question is whether

Table 1. Age-standardized mortality per 100,000 population in age group 35–74 by sex in Tianjin, China, the United States, and North Karelia, Finland

Cause of death and ICD-9 code number	Tianjin		United States ¹		North Karelia	
	Number	Unadjusted rates	Number	Unadjusted rates	Number	Unadjusted rates
Men (total number)	63,250		37,316,000		36,171	
Total mortality.	926	939	1,175	1,313	1,587	1,733
Ischemic heart disease (410–414)	99	101	373	420	730	802
Cerebrovascular disease (430–438)	243	247	49	57	103	113
All cancer (140–208)	258	263	322	361	311	340
Cancer of trachea, bronchus, and lung (162)	77	77	126	141	140	158
Women (total number)	64,715		40,956,000		39,654	
Total mortality.	789	773	616	751	584	810
Ischemic heart disease (410–414)	83	80	129	169	164	247
Cerebrovascular disease (430–438)	241	235	38	48	62	93
All cancer (140–208)	187	185	231	271	168	219
Cancer of trachea, bronchus, and lung (162)	62	62	47	55	10	13

¹White men and women.

Table 2. Mean risk factor levels in age group 25–64, by sex, in Tianjin, China, the United States, and North Karelia, Finland¹

Risk factor	Tianjin	United States	North Karelia
<i>Men</i>			
Cholesterol (mean mg per dl)	158	216	241
Systolic blood pressure (mean mm Hg)	124	129	145
Diastolic blood pressure (mean mm Hg)	80	84	86
Mean salt intake (grams)	18	...	14
Percentage of smokers	66	42	36
Number of cigarettes per day among smokers	13	24	19
<i>Women</i>			
Cholesterol (mean mg per dl)	166	216	244
Systolic blood pressure (mean mm Hg)	121	122	142
Diastolic blood pressure (mean mm Hg)	78	79	84
Mean salt intake (grams)	14	...	10
Percentage of smokers	20	31	14
Number of cigarettes per day among smokers	11	20	11

¹See Methods Section for differences in techniques used in each locale for measuring cholesterol and salt intake, and the differences in population samples.

NOTE: mg per dl = milligrams per deciliter; mm Hg = millimeters of mercury.

the developing countries will be able to avoid the enormous burden now afflicting industrial countries.

The Tianjin project is one effort to identify ways to avoid the increases in cardiovascular diseases and cancer. Tianjin is an urban county in China that has 8.46 million inhabitants. The aim of the project is to build a comprehensive community-based system to prevent and control major chronic diseases such as heart disease, cancer, and stroke.

This paper describes mortality, cardiovascular risk factor levels, and diet existing before the program in Tianjin began and compares them with those in North

Karelia, a province of Finland, and in the United States. North Karelia is known to have the highest coronary mortality in the world, whereas the United States represents a country with a coronary mortality rate that is about average for the industrialized world.

Subjects and Methods

Tianjin County. We used the provincial vital statistics records to calculate mortality rates for people ages 35–74. Mortality has been age-standardized against the world population (7). For the risk factor assessment, a representative sample of the population ages 25–64 was obtained from 13 sites scattered throughout the county, each centered around a local health center. The total population in those sites is approximately 400,000. Health center staff members obtained the information on all residents in their area of coverage during 1985.

A total of 60 trained physicians and 20 trained nurses measured participants' blood pressure twice on the same visit. Both measurements were taken from the right arm, after 5 minutes rest, and with the participant in a sitting position. The blood pressure we report is the mean of the two measurements. Blood specimens were taken after the blood pressure measurement with the person in a sitting position. Serum total cholesterol was analyzed by using an enzymatic assay. Standard enzyme preparation was provided by Shanghai Medicine Industry Research Institute, whose laboratory is standardized by the World Health Organization (WHO) reference laboratory in Beijing. Questions on smoking were asked during the interview. Twenty four-hour dietary recall was collected by trained interviewers. To estimate dietary salt intake, urinary salt excretion was measured from the first morning specimen and adjusted by using creatinine clearance and length of time since last voiding.

North Karelia. We calculated mortality statistics from the national mortality register for 1982 and standardized them against the world population (7). Risk factor levels were measured in a 1982 population-based sample, chosen according to the WHO Monitoring Trends and Determinants in Cardiovascular Disease (MONICA) protocol (9). Each 10-year age and sex group had 500 persons ages 25–64. A population subsample provided a 3-day dietary record (10) and a urine sample from a 24-hour period (11). Blood pressure was measured in the right arm of a person in a sitting position after 5 minutes rest. The mean of the two measurements is reported. Serum cholesterol was measured using an enzymatic assay at the National Public Health Laboratory of Finland. This laboratory is standardized against the WHO reference laboratory in Prague, Czechoslovakia. Smoking prevalence was ascertained by questionnaire.

United States. We used national vital statistics to calculate the 1982 mortality rate (12). Mortality was standardized against the world population (7). The National Health and Nutrition Examination Survey (NHANES II) was used for the risk factor description. Data on the sample, which is representative of the non-institutionalized civilian United States population, was collected from 1976 through 1980. In this report we used data for whites only. Blood pressure was measured with the person in a sitting position after 5 minutes rest. The mean of two seated measurements is used. Serum cholesterol was measured by an AutoAnalyzer II instrument and by the Liebermann Burchard method. Smoking prevalence was assessed by questionnaire and diet by 24-hour recall (13).

Results

Age-standardized total mortality among men was highest in North Karelia and lowest in Tianjin (table 1). The greatest differences were in coronary mortality rates, which for men were 99 per 100,000 in Tianjin, 730 per 100,000 in North Karelia, and 373 per 100,000 in the United States. Stroke in men was more prevalent in Tianjin (243 per 100,000) than in North Karelia (103) or the United States (49). Both the all-cancer and lung cancer mortality rates in men were lower in Tianjin than in the United States or North Karelia; both of these had about the same rates.

The differences among total mortality rates for the three locales were less pronounced among women than among men. Age-standardized total mortality for women was highest in Tianjin and lowest in North Karelia. The mortality rate for ischemic heart disease in women was much higher in North Karelia (164 per

Figure 1. Stroke mortality among men by age in Tianjin, China, in the United States and in North Karelia, Finland

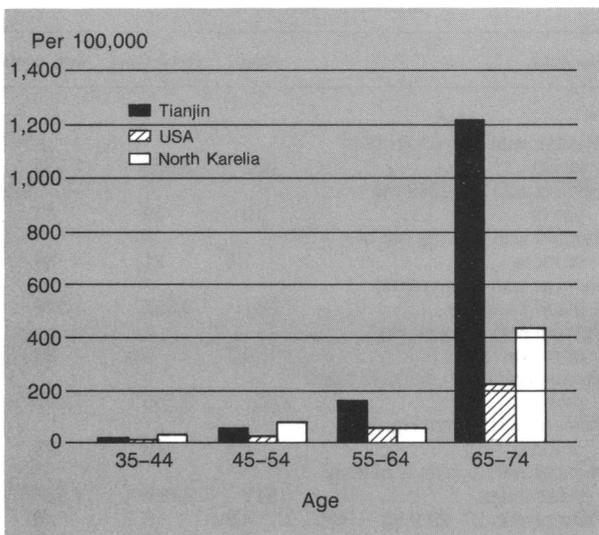
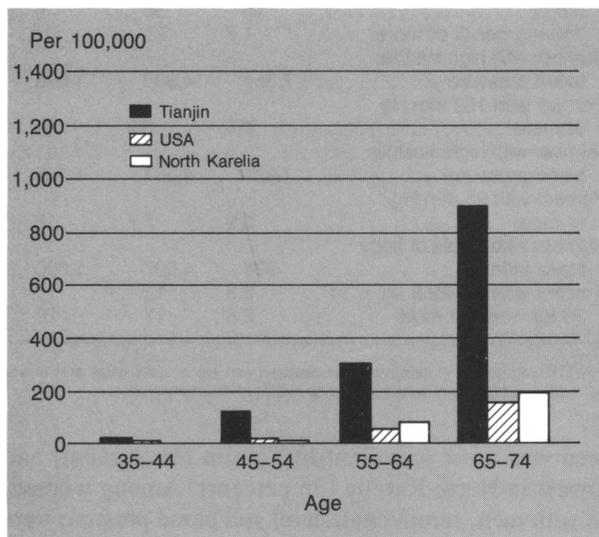


Figure 2. Stroke mortality among women by age in Tianjin, China, in the United States and in North Karelia, Finland



100,000) than in Tianjin (82), but stroke mortality was much higher in Tianjin (241) than in North Karelia (62). The lowest stroke mortality rate in women was observed in the United States (38 per 100,000). The greatest difference occurs in the older age groups (figures 1 and 2).

Among men, mean serum total cholesterol was highest in North Karelia (241 milligrams per deciliter—mg per dl) and lowest in Tianjin (158 mg per dl) (table 2). Both systolic and diastolic blood pressure levels in men were highest in North Karelia, although urinary salt excretion was lower there than in Tianjin. Smoking in

Table 3. Percentages of persons in age group 25–64 with high levels of risk factors, by sex, in Tianjin, China, the United States, and North Karelia, Finland

Risk factor	Tianjin	United States	North Karelia
Men			
Number with high cholesterol level	492	3,655	1,528
Percent with 200–249 mg per dl	10	39	43
Percent with 250 mg per dl or more	1.6	21	39
Number with high systolic blood pressure	7,351	3,655	1,528
Percent with 160 mm Hg or more	4.7	5.5	23
Number with high diastolic blood pressure	7,351	3,655	1,535
Percent with 95 mm Hg or more	7.1	13	25
Number with high level of body mass index	917	3,655	1,537
Percent with 27–29.9 kg ÷ m ² or 30 kg ÷ m ² or more	4.9	19	26
	0.3	13	16
Women			
Number with high cholesterol level	552	4,007	1,679
Percent with 200–249 mg per dl	15	36	38
Percent with 250 mg per dl or more	1.8	23	37
Number with high systolic blood pressure	7,351	4,007	1,678
Percent with 160 mm Hg or more	8.1	5.2	21
Number with high diastolic blood pressure	7,931	4,007	1,678
Percent with 95 mm Hg or more	8.9	7.7	18
Number with levels of body mass index	994	4,007	1,680
Percent with 27–29.9 kg ÷ m ² or 30 kg ÷ m ² or more	6.8	12	17
	2.5	17	20

NOTE: mg per dl = milligrams per deciliter; mm Hg = millimeters of mercury; kg ÷ m² = kilograms of weight divided by meters of height squared.

men was most prevalent in Tianjin (66 percent) and lowest in North Karelia (36 percent). Among women, as with men, serum cholesterol and blood pressure were highest in North Karelia and lowest in Tianjin. Urinary salt excretion in women was higher in Tianjin than in North Karelia.

Smoking prevalence among women was lower in North Karelia (14 percent) than in the United States (31 percent) or Tianjin (20 percent). Among men smokers, the average number of cigarettes smoked per day was 13 in Tianjin, 24 in the United States, and 19 in North Karelia. In all the three locales women smoked slightly fewer cigarettes per day than men.

Table 3 shows the proportion of people with elevated risk factor levels. In North Karelia, about 80 percent of the men in the sample population had elevated serum cholesterol levels (more than 200 mg per dl), compared

with only 12 percent in Tianjin. Hypertension for men and women was also more common in North Karelia than in Tianjin or the United States. Differences in hypertension prevalence between the United States and Tianjin were relatively small, except for diastolic blood pressure in men. Overweight and obesity were most prevalent in North Karelia, where 42 percent of men and 37 percent of women had a body mass index of 27 kilograms of weight divided by meters of height squared (kg ÷ m²) or more, and least prevalent in Tianjin (5.2 percent of men and 9.3 percent of women).

The total fat intake among men represented 26 percent of daily energy intake in Tianjin, 38 percent in North Karelia and 37 percent in the United States (table 4). Saturated fats accounted for 7 percent of the energy intake in men in Tianjin, 13 percent in the United States, and 20 percent in North Karelia. The proportion of polyunsaturated fats was 10 percent in Tianjin, 5 percent in the United States, and 4 percent in North Karelia. The actual proportion of polyunsaturated fats in the United States is slightly higher, since only linoleic acid was reported in this category.

There were small differences between men and women in these proportions, although women consumed fewer calories than men in each of the three locales, particularly in the United States. The total caloric intake was higher in North Karelia than in Tianjin in both men and women. It was lowest in United States women. Differences in protein intake were small. Men in Tianjin ate more carbohydrates, 62 percent of the energy intake (table 4), than those in North Karelia (45 percent) or the United States (42 percent). These levels were roughly the same for women.

Discussion

The differences we observed in diet, cholesterol level, and coronary heart disease mortality rates fit together well. Both men and women in Tianjin obtained 7 percent of their energy intake from saturated fats. Only 12 percent of the population ages 25–64 had elevated blood cholesterol, and the coronary mortality rate was 99 per 100,000 for men ages 35–74. In North Karelia, 20 percent of the population's energy intake came from saturated fats; 80 percent of the people had elevated cholesterol levels, and the coronary mortality rate was 730 per 100,000 for men and 164 per 100,000 for women. The United States falls between these extremes in all three measures.

Different age distributions in the selected countries may strongly affect these comparisons. The mortality, risk factor, and dietary data were age standardized against world population. The greatest effect was on total mortality among women. Without the standardiza-

tion, there were practically no differences between the countries; after standardization, total mortality among women was slightly higher in Tianjin than in the other two locales. On cholesterol, blood pressure, and diet the standardization effects were less and did not change the overall order of the countries. Smoking prevalence is not related in the same way to age in different countries. For these reasons only the mortality rates are reported in standardized and unstandardized form.

Although urinary salt excretion intake was higher in Tianjin than in North Karelia, the blood pressure was lower in the Tianjin population. The stroke mortality rate in Tianjin was much higher, however. Many factors can contribute to hypertension and stroke, but these findings argue against the hypothesis that high salt intake leads to high blood pressure and that accounts for the high stroke mortality in Tianjin. In a well controlled trial in 40 North Karelia families, blood pressure did not decline although salt intake fell from 12 grams daily to 6 grams. However, when persons reduced their fat intake to 25 percent of their energy intake and increased their polyunsaturated to saturated fat ratio from 0.16 to 1, blood pressure was lowered both among normotensive and hypertensive persons (14). High blood pressure in North Karelia may be related to an unusually low intake of polyunsaturated fats.

Recent data from the Multiple Risk Factor Intervention Trial (16) indicate an inverse association, for middle-age men, between intracranial hemorrhage and the combination of high blood pressure and low serum cholesterol level. This association may be related to high level of polyunsaturated fats in the diet, because there is evidence to suggest that these fatty acids can reduce platelet aggregation (17). We can only speculate about a possible association between Tianjin's high mortality rates for stroke and its comparatively high proportion of men who have both low serum cholesterol levels (under 160 mg per dl) and high blood pressure (diastolic blood pressure over 90 millimeters of mercury mm Hg). Only a very small proportion of men in North Karelia and in the United States fell into this category in our study.

Tianjin's high mortality rates for stroke may also arise from its high rates for smoking prevalence, since smoking is known to contribute to stroke mortality. Alcohol consumption is also known to be related to stroke, but our study had no available data for comparing alcohol intake in the three locales. China already exceeds the United States and Finland in its rate of smoking. During the study period, 66 percent of Chinese men were smoking, which is about the same level as North Karelia had in the 1950s. China must begin, as Finland and the United States are now doing, aggressively to encourage smoking cessation among

Table 4. Mean nutrients intake in grams and percent of energy it provides, by sex, in persons ages 25-64, in Tianjin, China, the United States, and North Karelia, Finland¹

Nutrient	Tianjin		United States		North Karelia	
	Grams	Percent	Grams	Percent	Grams	Percent
Men						
Fats.....	75	26	102	37	127	38
Saturated fats.....	18	7	237	13	66	20
Monounsaturated fats..	26	9	238	14	42	12
Polyunsaturated fats...	27	10	214	5	13	4
Carbohydrates.....	394	62	255	42	344	45
Proteins.....	76	12	96	16	111	15
Total calories...	2,555 kcal		2,446 kcal		2,958 kcal	
Number of men.....	282		3,655		208	
Women						
Fats.....	63	27	63	36	87	36
Saturated fats.....	15	7	222	13	46	19
Monounsaturated fats..	21	9	223	14	29	12
Polyunsaturated fats...	22	10	29	5	10	4
Carbohydrates.....	313	61	172	45	266	49
Proteins.....	60	12	63	16	78	15
Total calories...	2,051 kcal		1,533 kcal		2,135 kcal	
Number of women....	334		4,007		235	

¹See Methods section for differences between countries in obtaining dietary information.

²For the United States, only oleic acid was calculated for monounsaturated fats and only linoleic acid for polyunsaturated fats.

adults and discourage the onset of smoking among adolescents. Such antismoking activities require a mixture of legislative, health education, environmental, and financial efforts.

In some ways, China is well suited for such interventions. Although smoking prevalence is higher in Tianjin, smokers in both North Karelia and the United States consume, per capita, more cigarettes per day. The cost of cigarettes may be a factor here, since citizens of the latter two countries have higher average personal income than Chinese citizens. Another advantage for China is the relatively low smoking prevalence rate for women. Action should be taken, however, to ensure that Chinese women retain this health advantage. A well-planned national strategy may help the Chinese reduce their smoking prevalence. In Finland, an increase in women's smoking in the late 1970s has since been arrested, apparently because of tobacco legislation and other antismoking activities. Men's smoking has been declining for a longer time period. Such activities in the United States have likewise reduced the prevalence of smoking, although at a slower rate among women.

The Chinese may also follow the lead—and avoid the mistake—of industrial countries in adopting a major strategy for preventing coronary heart disease, not only by decreasing smoking prevalence but by preventing an

increase in consumption of saturated fats. Many developing countries still have an opportunity to avoid the problem currently faced by many industrial countries, which, having increased their intake of meat and dairy products a few decades ago, are now trying to reduce the use and production of these dietary items. This advice may be the most important message researchers can give to the health personnel, politicians, and people in China and in other countries with low levels of coronary heart disease.

It is important to emphasize that we should not generalize data from Tianjin as representative of China as a whole. There are considerable differences in risk factors and disease rates between urban and rural areas and level of development in different geographic regions of China (18). Several other large-scale studies are being undertaken in China, and these results, when published, will make interesting comparisons with the data we present in this paper.

A study on diet, physical activity, and bowel cancer comparing Chinese residents of North America with Chinese from Hangzhou and Ningbo reinforces some of our findings (19). The residents of Hangzhou and Ningbo have higher dietary caloric intake and lower weight than their North American comparison group. This study also reports that residents of China are more physically active than the North American Chinese.

Different populations may also have different major factors affecting blood pressure. Thus, cross cultural comparisons cannot rule out the possible etiologic role of salt in hypertension-related mortality in Tianjin. Because blood pressure levels in the United States and Tianjin are similar, the much higher stroke mortality rate in Tianjin requires other explanations. It is estimated that 63 percent of the stroke is hemorrhagic in Tianjin as opposed to 15–25 percent in the United States (15). An epidemiologic and pathologic study of stroke and its causes in China may help to explain these phenomena. Studies in China may clarify whether a reduction in salt intake will lead to a reduction in blood pressure. A large study like the Tianjin project may help to explore the feasibility and effects of a large scale campaign in Chinese society.

In summary, this comparison of diet, cardiovascular risk factors, and mortality rates among Tianjin, North Karelia, and the United States has several findings that are of public health importance. A low overall level of saturated fats in the diet of citizens of Tianjin was associated with both a low cholesterol level and low coronary mortality rates. Despite the relatively high level of salt intake in Tianjin, blood pressure was no higher there than in North Karelia or the United States, even though stroke mortality was higher in Tianjin. Other studies are needed to seek alternative causes or explanations for China's high mortality rates for stroke.

References

1. The health consequences of smoking: cardiovascular disease. A report of the Surgeon General. Publication No. DHHS (PHS) 84-50204. U.S. Government Printing Office, Washington, DC, 1983.
2. Surgeon General's report on nutrition and health. Publication No. DHHS (PHS) 88-50211. U.S. Government Printing Office, Washington, DC, 1988.
3. Proceedings from the Conference on the Decline in Coronary Heart Disease Mortality. NIH Publication No. 79-1610. U.S. Government Printing Office, Washington, DC, 1979.
4. Tuomilehto, J., et al.: Decline in mortality from coronary heart disease in North Karelia and other parts of Finland. *Br Med J* 293: 1068-1071 (1986).
5. Pisa, Z., and Uemura, K.: Trend of mortality from ischemic heart disease and other cardiovascular diseases in 27 countries 1968-77. *World Health Stat Q* 35:11-17 (1982).
6. Uemura, K., and Pisa, Z.: Recent trends in cardiovascular mortality in 27 countries: industrialized countries. *World Health Stat Q* 38: 142-162 (1985).
7. Waterhouse, J., et al., editors: Cancer incidence in five continents. Vol. 4. International Agency for Research on Cancer, Lyon, France, 1982.
8. WHO MONICA Project: geographic variation in mortality from cardiovascular disease. *World Health Stat Q* 40: 170-184 (1987).
9. The World Health Organization MONICA project (monitoring trends and determinants in cardiovascular disease)—a major international collaboration. *J Clin Epidemiol* 41: 105-144 (1988).
10. Pietinen, P., Uusitalo, U., Vartiainen, E., and Tuomilehto, J.: Dietary survey of the FINMONICA project in 1982. *Acta Med Scand* 1728 (suppl): 169-177 (1988).
11. Pietinen, P., et al.: Changes in dietary habits and knowledge concerning salt during a community-based prevention program for hypertension. *Ann Clin Res* (suppl) 143: 150-155 (1984).
12. Vital statistics of the United States 1982. vol. II, pt. A. Mortality. National Center for Health Statistics, Public Health Service, U.S. Department of Health and Human Services, 1986.
13. McDowell, A., et al.: Plan and operation of the Second National Health and Nutrition Examination Survey, 1976-80. *Vital Health Stat [1] No. 15*, Programs and collection procedures. National Center for Health Statistics, 1981.
14. Puska, P., et al.: Controlled, randomized trial of the effect of dietary fat on blood pressure. *Lancet* 8314/15: 1-6, Jan. 1 and 8, 1983.
15. Kuller, L. H.: Epidemiology of stroke. In *Advances in Neurology*, vol. 19, edited by B. S. Schoenberg. Raven Press, New York, 1978, pp 281-311.
16. Iso, H., et al.: Serum cholesterol levels and six year mortality from stroke in 350,997 men screened for the multiple risk factor intervention trial. *N Engl J Med* 320: 904-910, Apr. 6, 1989.
17. Goodnight, S. H., Jr., Harris, W. S., Connor, W. E., and Illingworth, D. R.: Polyunsaturated fatty acids, hyperlipidemia, and thrombosis. *Arteriosclerosis* 2: 87-113 (1982).
18. China: Long-term issues and options in the health transition. Report No. 7965-CHA (restricted distribution) The World Bank, Washington, DC, 1990.
19. Whittemore, A. S., et al.: Diet, physical activity, and colorectal cancer among Chinese in North America and China. *J Natl Cancer Inst* 82: 915-926 (1990).